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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention supplies for them electric power or receives reactive power, effective power or reactive power, and effective power to electric power system, and relates to the protective device of the series compensation system aiming at either of the control of control of the tidal current of electric power system, stabilization of an electrical potential difference, and power agitation.

[0002]

[Description of the Prior Art] In order to perform control of the tidal current of electric power system, stabilization of an electrical potential difference, and control of power agitation conventionally The series compensation system which used the self-excitation formula translation machine (self-excitation type power converter) is developed variously. There are a serial active filter, a self-excitation type series capacitor, a self-excitation type phase adjuster (what minded another side, minded the series transformer at the network, and connected to the serial one side of two pairs of self-excitation formula translation machines connected in the direct-current part), etc. in this.

[0003] Drawing 4 is the outline block diagram of the self-excitation type series capacitor which is a kind of the series compensation system of the conventional three phase which used the self-excitation formula translation machine. In drawing 4, the secondary winding of the series transformer 3 of a three phase is connected to a serial, respectively, and the self-excitation formula translation machine 5 described below is connected to the connection of the 1st three-phase-alternating-current electric power system 1 and the 2nd three-phase-alternating-current electric power system 2 at the primary winding of a series transformer 3. That is, the self-excitation formula translation machine 5 consists of an energy generation means or the energy supply means 9, such as the transformer 6 for converters with which Y connection of the secondary winding was carried out, and delta connection of the primary winding was carried out, the unit converter 7, the storage-of-energy means 8 like a smoothing capacitor, a fuel cell, and a solar battery, and these are connected as shown in drawing.

[0004] The configuration in which the self-excitation formula translation machine 5 generally multiplexed two or more sets of the unit converters 7 in which an output of the electrical potential difference of a three phase is possible using the transformer 6 for converters for large-capacity-izing is used, and, as for each unit converter 7, the circuit where diode 7D was connected to reverse juxtaposition at the self-extinction of arc form semiconductor device, gate turn-off thyristor (GTO) 7G [for example,], consists of six pieces.

[0005] While smooth [of the direct current power from an energy generation means or the energy supply means 9] is carried out with the storage-of-energy means 8 by such conventional series compensation system of a configuration It is changed into alternating current power by the unit converter 7, and the alternating voltage based on this changed alternating current power Control of the tidal current of electric power system 1 and 2, stabilization of an electrical potential difference, or control of power agitation can be performed by supplying electric power system 1 and 2 through the transformer 6 for converters, and a series transformer 3.

[0006]

[Problem(s) to be Solved by the Invention] However, when network accident, such as 3 line ground

and 1 line ground, occurs in the electric power system 1 and 2 mentioned above, in the self-excitation formula translation vessel 5, the excessive current corresponding to the ground current which flows to electric power system 1 and 2 flows. The current which flows in this self-excitation formula translation vessel 5 is determined by the property of the current and series transformer 3 which flow to electric power system 1 and 2. Therefore, the self-excitation formula translation machine 5 must be designed and manufactured so that the self-excitation formula translation machine 5 may not be damaged according to the current which flows in the self-excitation formula translation vessel 5 at the time of the occurrence of electric-power-system accident. In this way, the self-excitation formula translation machine 5 designed and manufactured serves as mass equipment as compared with the self-excitation formula translation machine 5 which assumed that network accident did not occur, and was designed and manufactured, and has enlargement and the difficulty of forming an expensive rank.

[0007] Furthermore, by failure etc., when the self-excitation formula translation machine 5 stops, it should separate into electric power system 1 and electric power system 2, or it is connected with a casualty which expands failure of the self-excitation formula translation machine 5.

[0008] Therefore, to make it neither separation of electric power system nor failure of a self-excitation formula translation machine expanded also at the time of a halt of the self-excitation formula translation machine by failure etc. with enabling it to design and manufacture the series compensation system which the self-excitation formula translation machine 5 does not damage at the time of the occurrence of network accident, either without large-capacity-izing was desired.

[0009] It was made in order that this invention might solve said technical problem, and it is to offer the protective device of a series compensation system which raises whenever [insurance / of a series compensation system] while it connects with electric power system at a serial and the series compensation system aiming at control of the tidal current of electric power system, stabilization of the electrical potential difference of electric power system, and control of power agitation of electric power system can constitute the purpose using the self-excitation formula translation machine of small capacity.

[0010]

[The means for solving invention] In order to attain said purpose, invention corresponding to claim 1 The secondary winding of a series transformer is connected to a part of electric power system at a serial. To the primary winding of this series transformer at least The self-excitation formula translation machine which consists of self-extinction of arc form semiconductor devices is connected, and the electrical potential difference based on the power of the request obtained by the output side by supplying power to the input side of this self-excitation formula translation machine is supplied to said electric power system through said series transformer. Control of the tidal current of said electric power system, stabilization of the electrical potential difference of said electric power system, In the series compensation system aiming at either of the control of power agitation of said electric power system The viper switch which comes to connect with reverse juxtaposition the nonself extinction of arc form semiconductor device for performing the short circuit between the lines of a track which connect electrically said series transformer and said self-excitation formula translation machine, or the ground of this track, It is the protective device of the series compensation system possessing the control means which controls said bypass switch to an ON state according to the ignition command determined that said self-excitation formula translation machine will not serve as an overcurrent to the nonself extinction of arc form semiconductor device of this viper switch.

[0011] In order to attain said purpose, invention corresponding to claim 2 The secondary winding of each phase of the series transformer of a three phase is connected to a part of each phase of the electric power system of a three phase at least at a serial, respectively. The self-excitation formula translation machine of the 3 phase configuration which becomes the primary winding of each phase of this series transformer from a self-extinction of arc form semiconductor device is connected, respectively. The electrical potential difference based on the power of the request obtained by the output side by supplying power to the input side of this self-excitation formula translation machine is supplied to said electric power system through said series transformer. Control of the tidal current of said electric power system, In the series compensation system of the three phase aiming at either of the control of stabilization of the electrical potential difference of said electric power system, and

power agitation of said electric power system The viper switch of a 3 phase configuration which comes to connect with reverse juxtaposition the nonself extinction of arc form semiconductor device for performing the short circuit between the lines of each track of each phase which connect electrically said series transformer and said self-excitation formula translation machine, or the ground of each of this track, It is the protective device of the series compensation system possessing the control means which controls said bypass switch to an ON state according to the ignition command determined that said self-excitation formula translation machine will not serve as an overcurrent to the nonself extinction of arc form semiconductor device of this viper switch.

[0012] In order to attain said purpose, invention corresponding to claim 3 The secondary winding of a series transformer is connected to a part of electric power system at a serial. To the primary winding of this series transformer The self-excitation formula translation machine which consists of self-extinction of arc form semiconductor devices is connected at least. The electrical potential difference based on the power of the request obtained by the output side by supplying power to the input side of this self-excitation formula translation machine is supplied to said electric power system through said series transformer. Control of the tidal current of said electric power system, In the series compensation system aiming at either of the control of stabilization of the electrical potential difference of said electric power system, and power agitation of said electric power system The viper switch which connects with juxtaposition at the secondary winding of said series transformer, and comes to connect the nonself extinction of arc form semiconductor device for short-circuiting this secondary winding with reverse juxtaposition, It is the protective device of the series compensation system possessing the control means which controls said bypass switch to an ON state according to the ignition command determined that said self-excitation formula translation machine will not serve as an overcurrent to the nonself extinction of arc form semiconductor device of this viper switch.

[0013] In order to attain said purpose, invention corresponding to claim 4 The secondary winding of each phase of the series transformer of a three phase is connected to a part of each phase of the electric power system of a three phase at least at a serial, respectively. Carry out delta connection of the primary winding of each phase of this series transformer, and the self-excitation formula translation machine of the 3 phase configuration which becomes the primary winding of each of this phase by which connection was carried out from a self-extinction of arc form semiconductor device is connected, respectively. The electrical potential difference based on the power of the request obtained by the output side by supplying power to the input side of this self-excitation formula translation machine is supplied to said electric power system through said series transformer. Control of the tidal current of said electric power system, In the series compensation system of the three phase aiming at either of the control of stabilization of the electrical potential difference of said electric power system, and power agitation of said electric power system The viper switch of a 3 phase configuration which comes to connect with reverse juxtaposition the nonself extinction of arc form semiconductor device for performing the short circuit between the lines of each track of each phase which connect electrically said series transformer and said self-excitation formula translation machine, or the ground of each of this track, It is the protective device of the series compensation system possessing the control means which controls said bypass switch to an ON state according to the ignition command determined that said self-excitation formula translation machine will not serve as an overcurrent to the nonself extinction of arc form semiconductor device of this viper switch.

[0014] In order to attain said purpose, invention corresponding to claim 5 The secondary winding of each phase of the series transformer of a three phase is connected to a part of each phase of the electric power system of a three phase at least at a serial, respectively. Carry out delta connection of the primary winding of each phase of this series transformer, and the self-excitation formula translation machine of the 3 phase configuration which becomes the primary winding of each of this phase by which connection was carried out from a self-extinction of arc form semiconductor device is connected, respectively. The electrical potential difference based on the power of the request obtained by the output side by supplying power to the input side of this self-excitation formula translation machine is supplied to said electric power system through said series transformer. Control of the tidal current of said electric power system, In the series compensation system of the three phase aiming at either of the control of stabilization of the electrical potential difference of said

electric power system, and power agitation of said electric power system. The viper switch of a 3 phase configuration which connects with juxtaposition at each phase of the secondary winding of said series transformer, respectively, and comes to connect the nonself extinction of arc form semiconductor device for short-circuiting this secondary winding with reverse juxtaposition. It is the protective device of the series compensation system possessing the control means which controls said bypass switch to an ON state according to the ignition command determined that said self-excitation formula translation machine will not serve as an overcurrent to the nonself extinction of arc form semiconductor device of this viper switch.

[0015] In order to attain said purpose, invention corresponding to claim 6 Detect the current which flows to said electric power system, and this detection current is judged that the accident of said electric power system returned with having become the current which the self-extinction of arc form semiconductor device which constitutes said self-excitation formula translation machine can permit. It is the protective device of the series compensation system according to claim 1 to 5 further equipped with an off command generating means to give an off command to said bypass switch.

[0016] In order to attain said purpose, invention corresponding to claim 7 The current which makes said bypass switch controllable for every phase, and flows for every electric power system of each of said phase is detected. It is the protective device of a series compensation system given in either of claims 2, 4, and 5 further equipped with the control means which judges it as an accident phase with having exceeded the threshold among this detection current, and controls only said bypass switch corresponding to this accident phase to an ON state.

[0017]

[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained with reference to a drawing. Drawing 1 is a circuit diagram for explaining the 1st operation gestalt of this invention, and different points from the conventional example of drawing 4 are the bypass switch 10, the bypass switch ignition control means 11, and having newly added the network current detector 12.

[0018] A bypass switch 10 carries out Y connection of the three pieces for the circuit which comes to connect a nonself extinction of arc form semiconductor device, for example, a thyristor, with reverse juxtaposition, and grounds this neutral point. This bypass switch 10 is connected with the track which has connected the primary winding of a series transformer 3, and the secondary winding of the transformer 6 for converters of the self-excitation formula translation machine 5, respectively.

[0019] The network current which detects the current to which the network current detector 12 flows for the three-phase-alternating-current networks 1 and 2, and detected it is inputted into the bypass switch ignition control means 11. The bypass switch ignition control means 11 is for the self-excitation formula translation machine 5 to control a bypass switch 10 to an ON state according to the ignition command it was determined that will not become an overcurrent. When the network current specifically detected with the network current detector 12 is compared with the threshold set up beforehand and a network current exceeds a threshold, When an ON command is given to all the gate terminals of the thyristor which constitutes the bypass switch 10, respectively and a network current becomes below a threshold, That is, when network accident returns, while giving an off command to the thyristor which constitutes the bypass switch 10, this is interlocked with and an ON command is given to gate turn-off thyristor 7G of the unit converter 7.

[0020] Thus, according to the constituted 1st operation gestalt, the following operation effectiveness is acquired. This is explained with reference to drawing 2. The network current with which electric power system 1 and 2 will be detected with the network current detector 12 if a network ground fault occurs for a certain reason becomes large now, and since an ON command is given to a bypass switch 10 when the threshold set as the bypass switch ignition control means 11 is exceeded, a bypass switch 10 turns on. If a bypass switch 10 turns on, the ground will be carried out and between the lines of the track to which the transformer 6 for converters of a series transformer 3 and the self-excitation formula translation machine 5 is connected will become independent [a short circuit, or the output current of the self-excitation formula translation machine 5 and the current which flows to electric power system 1 and 2].

[0021] The excessive current which flows to the upstream (self-excitation formula translation machine side) of a series transformer 3 at the time of the occurrence of a ground fault of electric

power system 1 and 2 is bypassed to a bypass switch 10 by making a bypass switch 10 turn on, and this property enables it not to pass in the self-excitation formula translation vessel 5.

[0022] And network accident returns, and when the current which flows to electric power system 1 and 2 becomes below the threshold, i.e., the current which the self-excitation formula translation machine 5 permits, set as the bypass switch ignition control means 11, a bypass switch 10 is made to turn off. By carrying out like this, the current which the self-excitation formula translation machine 5 permits is not set as the magnitude according to the flowing network current at the time of the occurrence of network accident, but in order to perform control of the tidal current of electric power system 1 and 2, stabilization of an electrical potential difference, and control of power agitation, it can consider as the magnitude of the current needed in the condition other than the time of a network accident occurrence. That is, capacity needed for the self-excitation formula translation machine 5 can be made small.

[0023] Moreover, by making a bypass switch 10 turn on, it is not concerned with whether the self-excitation formula translation machine 5 has stopped, but it becomes possible to pass a current to electric power system 1 and 2. That is, even if the track where the self-excitation formula translation machine 5 is connected by failure of gate turn-off thyristor 7G which constitute the self-excitation formula translation machine 5 etc. will be in an open condition, the current of electric power system 1 and 2 becomes possible [flowing through a bypass switch 10].

[0024] Next, the 2nd operation gestalt of this invention is explained using drawing 3 . A different point from the operation gestalt of drawing 1 performs as follows series transformer 3A and the connection condition of the BAIBASU switch 10. That is, three circuits where delta connection of the primary winding of series transformer 3A was carried out, the node of this coil that carried out delta connection was connected to the secondary winding of the transformer 6 for converters, and the thyristor was connected to reverse juxtaposition between the lines of the track of this secondary winding and the primary winding of series transformer 3A are connected.

[0025] Thus, the following operation effectiveness is acquired by constituting. That is, while the zero phase which flows to electric power system 1 and 2 by making the primary winding of series transformer 3A, i.e., the coil by the side of a self-excitation formula translation machine, into delta connection flows to series transformer 3A, it does not flow in the self-excitation formula translation vessel 5.

[0026] When the coil by the side of a self-excitation formula translation machine is now made into Y connection temporarily like the configuration to which a zero phase current flows the coil by the side of the self-excitation formula translation machine of series transformer 3A in a self-excitation formula translation vessel, i.e., drawing 1 , the following troubles arise. That is, it must be made the configuration and capacity which permit the zero phase current of the zero phase current which flows at electric power system 1 and 2 to the transformer 6 for converters which constitutes the self-excitation formula translation machine 5, and enlargement and the formation of an expensive rank of the transformer 6 for converters are caused. Furthermore, at the time of the occurrence of a one-line ground accident by electric power system 1 and 2, a big zero phase current flows to the transformer 6 for converters. Although a bypass switch 10 also bypasses a zero phase current, it is that a bypass switch 10 actually turns on, after a zero phase current flows to the transformer 6 for converters. While the zero phase current which was flowing just before this turned on the bypass switch 10 in the track which passes along the transformer 6 for transducers and a bypass switch 10 declines with time amount, it will continue flowing. Since the bypass switch 10 is constituted from a thyristor, it does not have the capacity which intercepts this current that continues flowing. It is a time of the current which flows to a bypass switch 10 passing a zero point that a bypass switch 10 actually turns off, after putting in a signal, since it turns off to the ignition signal of a bypass switch 10. The current which flows to a bypass switch 10 serves as the sum of a current and the output current of the self-excitation formula translation machine 5 which flows to the converter side of series transformer 3A corresponding to the current which flows to electric power system 1 and 2. Usually, since the current which flows to the transducer side of series transformer 3A is an alternating current, the current which flows to a bypass switch 10 also turns into that it is interchanged, but after the transmission line has carried out the open phase, in order that a current may not flow to the transmission line which carried out the open phase, there is a case where the current which flows to a bypass switch 10

stops turning into that it is interchanged. In this condition, a bypass switch 10 will be turned off until the current which flows to a bypass switch 10 declines automatically and serves as zero. Since the current which flows to this bypass switch 10 goes via the zero phase circuit of the transformer 6 for transducers, its time constant of attenuation is long, and before a bypass switch turns off, it will usually take the time amount of hundreds of or more msec. Even if it waits for this and performs control of the tidal current of electric power system 1 and 2, stabilization of an electrical potential difference, and control of power agitation, the effectiveness of stabilization of the electric power system at the time of the occurrence of network accident will decrease greatly.

[0027] As shown in the operation gestalt of drawing 3, while the zero phase which flows to electric power system 1 and 2 by making the coil by the side of the self-excitation formula translation machine of series transformer 3A into delta connection flows to series transformer 3A, the above troubles Since it does not flow in the self-excitation formula translation vessel 5, while not causing the enlargement or the formation of an expensive rank of the transformer 6 for converters which constitute the self-excitation formula translation machine 5 Since a bypass switch 10 turns off for a short time also at the time of the occurrence of open-phase accident of electric power system 1 and 2, there is little reduction of the electric power system 1 at the time of the occurrence of network accident and the effectiveness of stabilization of two, and it ends.

[0028] <Modification> this invention is not limited to the 1st and 2nd operation gestalt described above, but deforms as follows and can be carried out.

[0029] (1) Although the operation gestalt mentioned above was the case of the series compensation system of a three phase, it may be the series compensation system of not only this but a single phase or a polyphase.

(2) In the circuit of drawing 1, even if it makes it connect with juxtaposition to the coil which removes the bypass switch 10 connected to the track on which the series transformer 3 and the transformer 6 for transducers are connected, and is connected to the secondary windings 1 and 2, i.e., the electric power system, of a series transformer 3 at the serial, respectively, the same operation effectiveness as the operation gestalt of drawing 1 is acquired. Points other than this are with the same configuration as drawing 1.

[0030] (3) In the circuit of drawing 3, even if it makes it connect with juxtaposition to the coil which removes the bypass switch 10 connected to the track on which the series transformer 3 and the transformer 6 for transducers are connected, and is connected to the secondary windings 1 and 2, i.e., the electric power system, of a series transformer 3 at the serial, respectively, the same operation effectiveness as the operation gestalt of drawing 3 is acquired. Points other than this are with the same configuration as drawing 3.

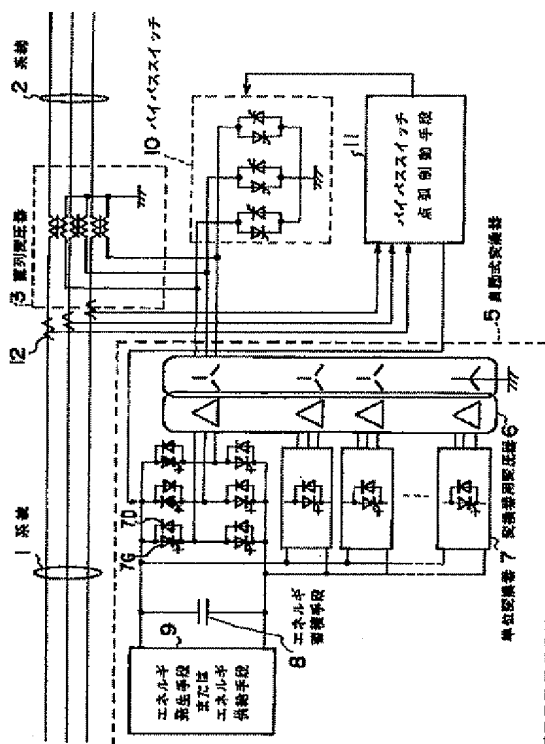
[0031] (4) In the circuit of drawing 3, the primary winding of a series transformer 3, i.e., the coil connected to a self-excitation formula translation machine side, is not made into delta connection, but the operation effectiveness same also as alternate connection as the operation gestalt of drawing 3 is acquired. Points other than this are with the same configuration as drawing 3.

[0032] (5) In the circuit of drawing 1 or drawing 3, the function of the bypass switch ignition control means 11 can also be performed as follows. The network current detector 12 detects the current which constitutes a bypass switch 10 controllable for every phase, and specifically flows for every electric power system of each phase, it is judged as an accident phase with having exceeded the threshold among each of this detection current, and you may make it control only the unit circuit which constitutes the bypass switch corresponding to this accident phase to an ON state.

[0033]

[Effect of the Invention] It becomes possible according to the protective device of the series compensation system of this invention not to pass the overcurrent at the time of the occurrence of network accident in a self-excitation formula translation vessel, and it can be small, a series compensation system can be offered cheaply, and it becomes still more possible to suppress the effect on electric power system to the minimum also at the time of failure of a self-excitation formula translation machine etc., and is effective in raising the safety of a series compensation system.

Drawing selection Representative drawing



[Translation done.]